But this formula does not enable us to obtain least values of p, q, and m, as n varies.

56. Proposed by G. B. M. ZERR, A. M., Ph. D., President and Professor of Mathematics in Russell College, Lebanon, Va.

If $\phi(R)$ is the number of integers which are less than R and prime to it, and if y is prime to R, show that $y^{\Phi(R)}-1\equiv0(\text{mod}.R)$.

Solution by the PROPOSER, and J. O. MAHONEY, B. E., M. Sc., Lynnville, Tenn.

Let $1, m, n, p, \ldots\ldots(R-1)$ denote the $\phi(R)$ numbers less than R and prime to it ; now y can be any one of those numbers.

$\therefore y, my, ny, py, \ldots\ldots(R-1)y$ are all prime to R and all different.

There are $\phi(R)$ of such products and since when these products are divided by R the remainders are all prime to R and all different, the $\phi(R)$ remainders must be $1, m, n, p, \ldots\ldots(R-1)$ though not necessarily in this order.

$\therefore y.my.ny.py\ldots\ldots(R-1)y$ must differ from $1.m.n.p\ldots\ldots(R-1)$ by a multiple of R.

$\therefore \{y^{\Phi(R)}-1\}mnp\ldots\ldots(R-1)=$a multiple of R.

But $mnp\ldots\ldots(R-1)$ is prime to R.

$\therefore y^{\Phi(R)}-1\equiv0(\text{mod}.R)$.

57. Proposed by JOSIAH H. DRUMMOND, LL. D., Portland, Maine.

Each of *five* of the digits may be the terminal figure of a perfect integral square. Each of *eighteen* combinations of two digits may be the *two* terminal figures of an integral square. Each of *one hundred and nineteen* combinations of three digits may be the *three* terminal figures of an integral square. *Under these conditions*, what is the greatest number of arrangements of the nine digits, all taken together, whose three terminal figures shall be those of a square number ?

No solution of this difficult problem has been received. Can any of our readers furnish the desired solution ? EDITOR.

MISCELLANEOUS.

53. Proposed by J. A. CALDERHEAD, M. Sc., Professor of Mathematics in Curry University, Pittsburg, Pa.

(a) What is the highest north latitude in which the Sun will shine in at the north window of a building at least once in a year ?

(b) How many days will it shine in at the north window of a building in latitude 41° N. ?

Note by SAMUEL HART WRIGHT, M. D., A. M., Ph. D., Penn Yan, N. Y.

Whenever the Sun, or any part of it, is north of the prime vertical, it must then shine on the north side of buildings. From the time of vernal equinox, to the autumnal equinox, the Sun will be north of the prime vertical during some part of every day, and will shine on the north side of buildings some part of *every* day for about half a year, and in *all* latitudes north of the equator. Hence the answer for (a) is 90° N. latitude, and for (b) 186 days, but if the Sun's upper